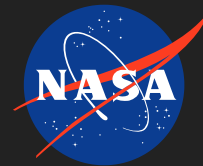


Game Changing Usage of High-Voltage Power Transmission Systems as Extremely Large Antennas for Space Physical and Geophysical

Remote Imaging

Completed Technology Project (2012 - 2013)



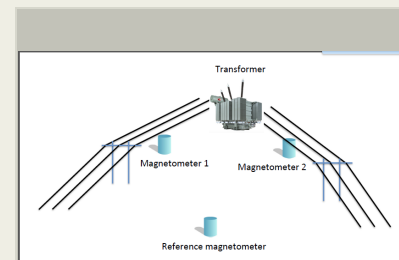
Project Introduction

We propose to use the US high-voltage power transmission system as an extremely large antenna to extract unprecedented spatiotemporal space physical and geological information from distributed geomagnetically induced current (GIC) observations. The power grid impacts are presently the highest space weather concern in US and Federal Energy Regulatory Commission's ongoing regulatory action will drive substantial industry and federal interests in the GIC problem in the near future. Consequently, the proposed game changing GIC observations set up offers not only opportunity for new big heliophysics science utilizing industrial structures but also potential for major interagency and public-private collaborations.

Geomagnetic storms drive geomagnetically induced currents (GIC) in high-voltage power transmission systems worldwide. GIC distribution in the transmission system is a function of the large-scale surface geoelectric field and DC characteristics of the transmission system. Geoelectric field carries information about magnetospheric-ionospheric electric current systems and geological structures. It is common to use information about magnetospheric-ionospheric electric current systems or geomagnetic field variations on the ground together with geological and transmission system description to model GIC. However, no work or technology exists for inverting spatiotemporal space physical and geological information from extensive distributed GIC observations. We will utilize the US high-voltage power transmission system for the first time as a science tool to map large scale GIC's. Large-scale application of the set up will allow unprecedented, game changing, extraction of space physical and geological information over wide range of spatial and temporal scales. Further, the new GIC observation set up can be turned into a valuable resource for the power transmission industry. We envision that the large-scale implementation of the concept can be carried out in collaboration with the industry and other federal agencies after the 1-year pilot phase. With sufficient funds, full-scale implementation of the concept with a larger number of GIC observation sites can be achieved within 2-3 years after the pilot phase.

Anticipated Benefits

N/A



Game Changing Usage of High-Voltage Power Transmission Systems

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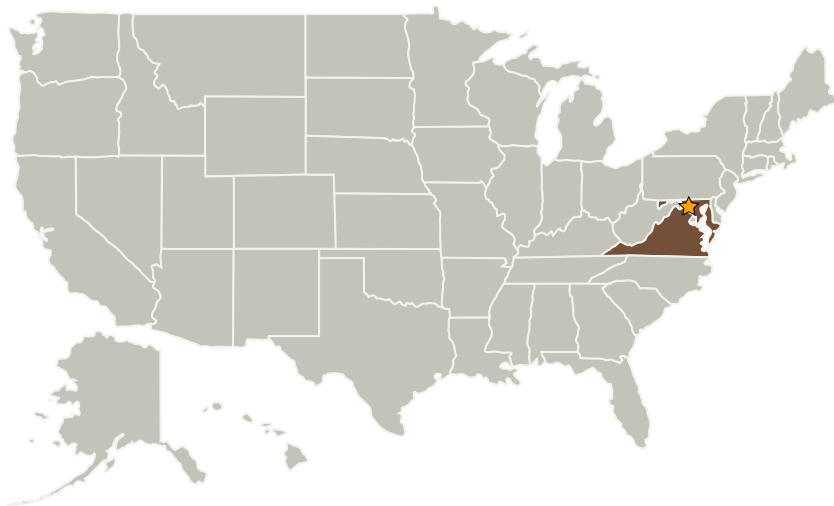
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Co-Funding Partners	Type	Location
Dominion Virginia Power	Industry	Virginia

Primary U.S. Work Locations	
Maryland	Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Peter M Hughes

Project Manager:

Stanley D Hunter

Principal Investigator:

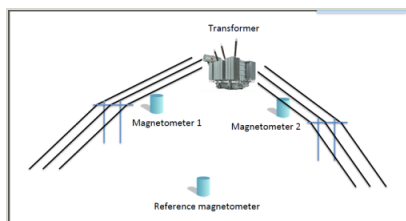
Antti A Pulkkinen

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Images



Game Changing Usage of High-Voltage Power Transmission Systems

Game Changing Usage of High-Voltage Power Transmission Systems

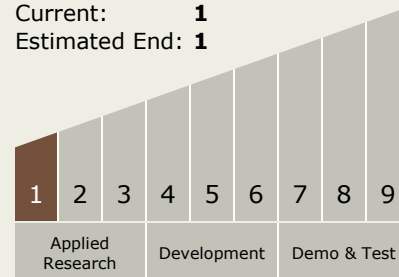
(<https://techport.nasa.gov/image/4080>)

Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - TX03.3 Power Management and Distribution
 - TX03.3.2 Distribution and Transmission